

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 6,831,936 B1
APPLICATION NO. : 09/633837
DATED : December 14, 2004
INVENTOR(S) : Donald V. Smart

Page 1 of 5

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

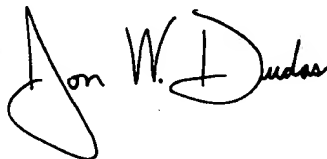
Delete the title page and substitute therefor the attached title page.

Replace sheets 1-3 of the drawings with the attached sheets 1-3. As shown in attached sheets

This certificate supersedes Certificate of Correction issued September 4, 2007.

Signed and Sealed this

Twenty-third Day of October, 2007

A handwritten signature in black ink, appearing to read "Jon W. Dudas". The signature is stylized with a large, looped initial "J" and a distinct "D".

JON W. DUDAS
Director of the United States Patent and Trademark Office

(12) **United States Patent**
Smart

(10) Patent No.: **US 6,831,936 B1**
(45) Date of Patent: **Dec. 14, 2004**

(54) **PULSE CONTROL IN LASER SYSTEMS**

- (75) Inventor: Donald V. Smart, Boston, MA (US)
(73) Assignee: GSI Lumonics Corporation, Billerica, MA (US)
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 28 days.

(21) Appl. No.: 09/633,837

(22) Filed: Aug. 7, 2000

Related U.S. Application Data

- (62) Division of application No. 09/096,600, filed on Jun. 12, 1998, now Pat. No. 6,339,604.
(51) Int. Cl.⁷ H01S 3/10
(52) U.S. Cl. 372/26; 372/13; 372/25; 372/108; 219/121.61
(58) Field of Search 372/13, 25, 26, 372/108; 219/121.61, 121.62, 121.82, 121.78, 121.83, 121.85

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,703,687 A	11/1972	Maydan	
3,747,019 A	7/1973	Koechner et al.	
4,337,442 A	6/1982	Mauck	372/13
4,341,446 A	7/1982	Burkel	
4,412,330 A	10/1983	Mauck et al.	372/29
4,461,005 A	7/1984	Ward et al.	
4,483,005 A	11/1984	Smart	372/25
4,590,598 A	5/1986	O'Hara, II	372/38
4,601,037 A	7/1986	McDonald	372/25
4,604,513 A	8/1986	Lim	
4,675,872 A	6/1987	Popek et al.	372/10
4,708,473 A	11/1987	Metzdorf et al.	356/5.04
4,730,105 A	3/1988	Mitschke et al.	250/205

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

JP 62086851 A2 4/1987 H01L27/01

OTHER PUBLICATIONS

General Scanning Inc., "Laser Link Fusing: Guidelines for the Applications of M3XX Laser Systems in Semiconductor Link Fusing Processes," Jan., 1997.

(List continued on next page.)

Primary Examiner—Minsun Oh Harvey

Assistant Examiner—Cornelius H Jackson

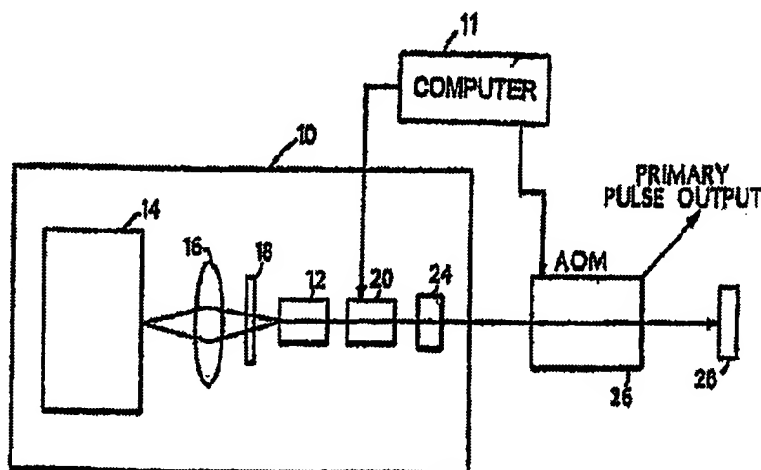
(74) Attorney, Agent, or Firm—Gauthier & Connors, LLP

(57)

ABSTRACT

A pulsed laser system includes a laser pump, a laser rod, a reflector interposed between the laser pump and the laser rod, through which energy from the laser pump enters the laser rod, an output reflector through which energy is emitted from the laser rod, a switch interposed between the laser rod and the output reflector, and a control device. The switch, when closed, causes energy to be stored in the laser rod and, when opened, allows energy to be emitted from the laser rod during an emission period. The control device allows a primary laser pulse emitted from the laser rod during the emission period to impinge on a workpiece and blocks from the workpiece secondary laser emission occurring during the emission period after emission of the primary pulse. The pulsed laser system is operated over a range of repetition rates, so as to cause laser energy to be emitted during a plurality of emission periods at each repetition rate. At least a portion of the laser energy emitted during the emission periods is directed toward the target structure in order to perform passive or functional trimming of the target structure. The switch is closed for a fixed, predetermined period of time prior to each emission period regardless of repetition rate of the primary laser pulse within the range of repetition rates in order to store energy in the laser rod. The pump is operated continuously at constant power.

49 Claims, 3 Drawing Sheets



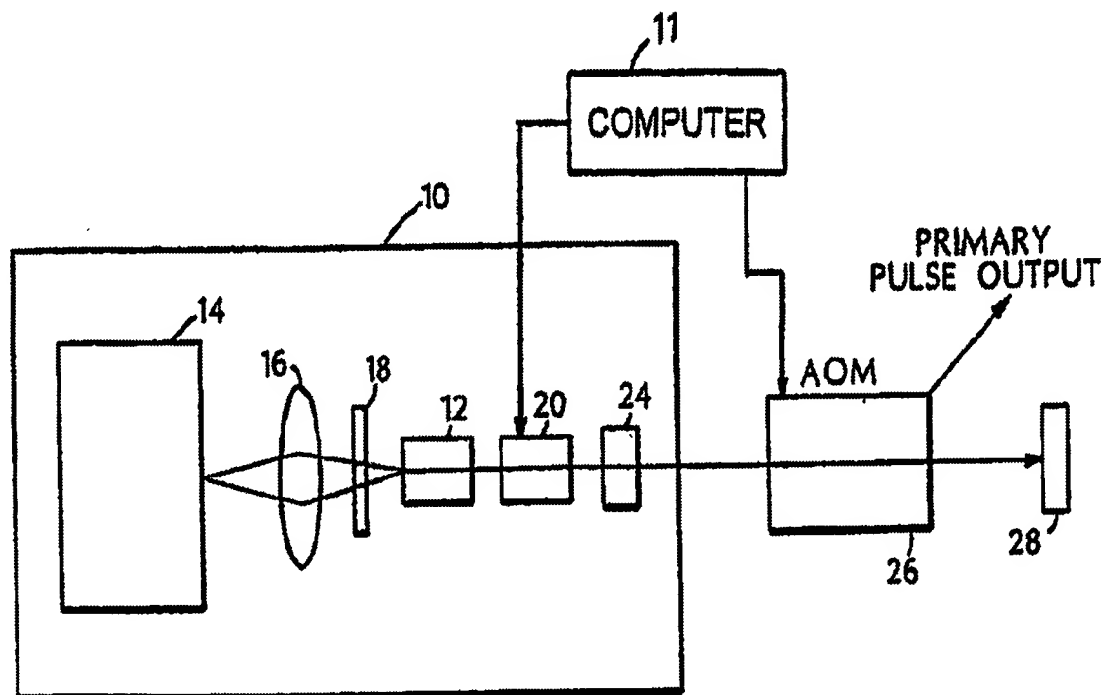


FIG. 1

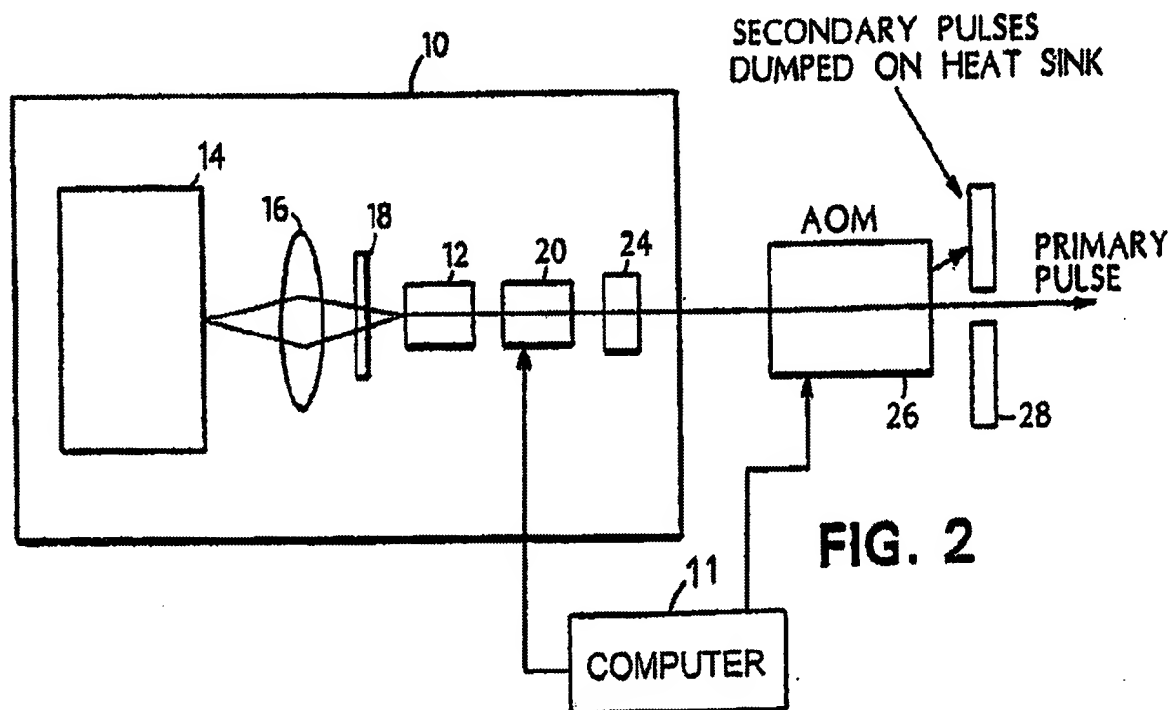


FIG. 2

